## IN THE SPECIFICATION

Please amend the paragraphs of the specification as follows:

On page 1, please replace the paragraph starting on line 16, with the following paragraph:

A modern day communication system is required to support a variety of applications. One such communication system is a code division multiple access (CDMA) system that supports voice and data communication between users over a terrestrial link. The use of CDMA techniques in a multiple access communication system is disclosed in U.S. Patent No. 4,901,307, entitled "SPREAD SPECTRUM MULTIPLE ACCESS COMMUNICATION SYSTEM USING SATELLITE OR TERRESTRIAL REPEATERS," and U.S. Patent No. 5,103,459, entitled "SYSTEM AND METHOD FOR GENERATING WAVEFORMS IN A CDMA CELLULAR TELEPHONE SYSTEM." Another specific CDMA system is disclosed in U.S. Patent Application Serial No. 08/963,386, entitled "METHOD AND APPARATUS FOR HIGH RATE PACKET DATA TRANSMISSION," filed November 3, 1997, now U.S. Patent No. 6,574,211, issued 6/3/2003, (hereinafter, the HDR system). These patents ~~and patent application~~ are assigned to the assignee of the present invention and incorporated herein by reference.

On page 2, please replace the paragraph starting on line 11, with the following paragraph:

The rake receiver provides an acceptable level of performance for CDMA systems operated at low signal-to-noise ratio (S/N). For CDMA systems designed to transmit data at high data rates, such as the HDR system, higher S/N is required. To achieve the higher S/N, the components that make up the noise term N need to be reduced. The noise term includes thermal noise (No), interference (Io) due to transmissions by other transmitting sources and transmissions for other users, and inter-symbol interference (ISI) that can come from multipath and distortion in the transmission channel. For CDMA systems designed to operate at low S/N, the ISI component is typically negligible compared to other noise components. However, for CDMA systems designed to operate at higher S/N, the other noise components (e.g., interference from other transmission sources) are typically reduced, and ISI becomes a non-negligible noise component that may have a large impact on the overall S/N.

On page 4, please replace the paragraph starting on line 9, with the following paragraph:

For the above adaptation schemes, the adaptation can be performed using, for example, time division multiplexed (TDM) pilot reference, and in accordance with a least mean square (LMS) algorithm, a recursive least square (RLS) algorithm, a direct matrix inversion (DMI) algorithm, or some other adaptation algorithm. Prior to the adaptation, the coefficients of each filter can be initialized to a particular set of values (e.g., 0, ..., 0, $\alpha*$, 0, ..., 0) and the scaling factor(s) can also be initialized. A large multipath for each signal being received and processed can be identified and the magnitude and phase of the multipath ($\alpha$) can be used to initialize the coefficients and scaling factor associated with the signal. A large multipath for one of the signal(s) being received and processed can also be identified and a time offset corresponding to this multipath can be used for the coefficient and scaling factor adaptation (e.g., the time offset can be used to properly generate the expected values).

On page 6, please replace the paragraph starting on line 32, with the following paragraph:

At a receiver unit 130, the transmitted signal is received by one or more antennas 132a-132k and provided to a receiver (RCVR) 134. Within receiver 134, each received signal is amplified, filtered, frequency downconverted, quadrature demodulated, and digitized to provide inphase (I) and quadrature (Q) samples. The samples may be digitally processed and then provided to a receive (RX) data processor 136 that further processes and decodes the samples to recover the transmitted data. The processing and decoding at receive data processor 136 are performed in a manner complementary to the processing and encoding performed at transmit data processor 114. The decoded data is then provided to a data sink 138.

On page 7, please replace the paragraph starting on line 21, with the following paragraph:

As shown in FIG. 2A, receiver unit 130 includes a number of antennas 132a through 132k that couple to a number of ~~pre-processor~~ pre-processors 210a through 210k used to process the signals received via the antennas. Each combination of antenna 132 and pre-processor 210 forms part of a signal path used to process a particular received signal. The use of multiple antennas

132 in receiver unit 130 provides spatial diversity and may further suppress interference from other transmission sources, both of which can improve performance. However, receiver unit 130 can also be designed with a single signal path and this is within the scope of the invention.

On page 7, please replace the paragraph starting on line 30, with the following paragraph:

FIG. 2A shows some of the functional elements that can be used to implement pre-processor 210. Generally, pre-processor 210 can include any combination of the functional elements shown in FIG. 2A, and the elements can also be arranged in any order to obtain the desired output. For example, multiple stages of amplifiers and filters are typically provided within pre-processor 210. Moreover, different functional elements than those shown in FIG. 2A may also be included within pre-processor 210, and this is also within the scope of the invention.

On page 9, please replace the paragraph starting on line 25, with the following paragraph:

FIG. 3 is a block diagram of receive data processor 136 in accordance with an embodiment of the invention. In this embodiment, receive data processor 136 includes two signal processing paths that can be operated in parallel to provide improved performance, especially at higher data rates. The first signal processing path includes an equalizer 310 coupled to a post processor 320, and the second signal processing path includes a rake receiver 330.

On page 11, please replace the paragraph starting on line 34, with the following paragraph:

Within filter 410, the received samples $x_i(n)$ are provided to a number of delay elements 512a through 512m coupled in series. Each delay element 512 provides a particular amount of delay (e.g., one clock cycle of the received sample rate clock, $1/f_{SAMP}$). The received samples $x_i(n)$ and the outputs of delay elements 512a through 512m are provided to multipliers 514a through 514l, respectively. Each multiplier 514 also receives a coefficient $c_{i,j}$, scales each received sample with the coefficient, and provides the scaled sample to a summer 516. Summer 516 sums the scaled samples from multipliers 514a through 514l and provides the symbol estimates $\hat{y}_i(n)$. The symbol estimates $\hat{y}_i(n)$ can be computed as:

$$\hat{y}_i(n) = \sum_{j=-M}^{M} c_{i,j}^* \cdot x_i(n-j) \ , \qquad\qquad \text{Eq (1)}$$

where the symbols (*) denotes a complex conjugate, and (2M+1) is the number of taps of filter 410.

On page 15, please replace the paragraph starting on line 17, with the following paragraph:

Each of the LMS, RLS, and DMI algorithm (directly or indirectly) attempts to minimize the mean square error (MSE), which may be expressed as:

$$MSE = E\left\{ \left| y(n) - \hat{y}_i(n) \right|^2 \right\} \ , \qquad\qquad \text{Eq (2)}$$

where $E\{x\}$ is the expected value of x. The LMS, RLS, DMI, and other adaptation algorithms are described in further detail by Simon Haykin in a book entitled "Adaptive Filter ~~Theory",~~ Theory," 3$^{rd}$ edition, Prentice Hall, 1996, which is incorporated herein by reference.

On page 19, please replace the paragraph starting on line 11, with the following paragraph:

Once the strongest multipath for all received signals is determined, the time offset corresponding to this multipath can be identified. The coefficient $c_{i,0}(n)$ for each filter 410 can then be initialized to one of the following: (1) a value related to a "finger ~~value",~~ value," which is indicative of the received signal quality of the strongest multipath (e.g., $c_{i,0}(n) = \gamma \, \alpha_{ji}^*$, where $\gamma$ is a constant that may be dependent on the noise variance), or (2) a value of one (1.0), or some other value. The remaining coefficients can each be initialized to zero (i.e., $c_{i,-M}(n) = \ldots = c_{i,-1}(n) = c_{i,1}(n) = \ldots = c_{i,M}(n) = 0.0$). The time offset, $\tau_{ji}$, corresponding to the strongest multipath, $\alpha_{ji}$, can be separated into a "coarse" portion and a "fine" portion. The coarse portion can be used as a coarse adjustment to properly generate the actual symbols $y(n)$ used to adapt the coefficients and scaling factors, as described below. The fine portion can be used as a fine adjustment to specify the time epic of the received samples $x_i(n)$. Specifically, the fine portion

can be used by digital processor 230 to ~~adjusting~~ adjust the timing of the resampling clock, which enables digital processor 230 to generate received samples $x_i(n)$ aligned (in time) to the time offset. The time offset for the generation of the actual symbols $y(n)$ also takes into account the number of taps of each filter 410 and the initial values of the coefficients.

On page 21, please replace the paragraph starting on line 9, with the following paragraph:

In the first adaptation scheme, time-domain adaptation is performed first followed by space-domain adaptation. To perform the time-domain adaptation, the scaling factors are initially set to a particular set of values, and the filter coefficients are then adapted. The initial values for the scaling factors may be determined, for example, using direction of arrival (DOA) estimation, which is known in radar theory and described by S. Haykin and A. Steinhardt, in a book entitled "Adaptive Radar Detection and ~~Estimation",~~ Estimation," John Wiley and Sons, June 1992. Alternatively, the scaling factors may each be initialized, for example, to 1/K. With the scaling factors fixed, the filter coefficients can then be adapted using the LMS, RLS, DMI, or some other algorithm, similar to that described above.

On page 22, please replace the paragraph starting on line 11, with the following paragraph:

FIG. 6 is a diagram of a data frame format for a forward link transmission in the HDR CDMA system. On the forward link, traffic data, pilot reference, and signaling data are time division multiplexed in a frame and transmitted from a base station to a remote terminal. Each frame covers a time unit referred to as a slot (e.g., 1.67 msec for a particular HDR design). Each slot includes traffic data fields 602a, 602b, and 602c, pilot reference fields 604a and 604b, and signaling data (OH) fields 606a and 606b. Traffic data fields 602 and pilot reference fields 604 are used to send traffic data and pilot reference, respectively. Signaling data fields 606 are used to send signaling information such as, for example, forward link activity (FAC) indicators, reverse link busy indicators, reverse link power control commands, and so on. The FAC indicators indicate whether the base station has traffic data to send in a particular number of slots in the future. The reverse link busy indicators indicate whether the reverse link capacity limit of

the base station has been reached. And the power control commands direct the transmitting remote terminals to increase or decrease their transmit power.

On page 22, please replace the paragraph starting on line 27, with the following paragraph:

In accordance with the HDR CDMA system, prior to transmission, the traffic data is covered with Walsh codes corresponding to the channels to be used for the data transmission, and the power control data for each remote terminal is covered with the Walsh code assigned to the remote terminal. The pilot reference, covered traffic data, and power control data are then spread with a complex PN spreading sequence generated by multiplying the short IPN and QPN spreading sequences assigned to the particular transmitting base station with the long PN sequence assigned to the recipient remote terminal. At the highest date rates, the bit rate may match or exceed the chip rate of the PN spreading sequence and the Walsh codes, and no direct sequence spreading of the data is achieved. The data frame format and the processing of the forward link transmission for the HDR system is described in further detail in the aforementioned U.S. Patent Application Serial No. 08/963,386, now U.S. Patent No. 6,574,211.

On page 24, please replace the paragraph starting on line 25, with the following paragraph:

The filter coefficients and scaling factors can also be adapted using the received data. The received samples can be processed, decoded, and CRC checked to determine whether a data packet was received without error. A correctly received data packet can then be re-encoded and re-processed in a manner similar to that performed at the ~~transmitted~~ transmitter unit. The re-generated symbols can then be compared against the recovered symbols (e.g., $\hat{y}(n)$), and the error between these can be used to adapt the filter coefficients and scaling factors. The recovered symbols are appropriately buffered to account for the decoding, re-encoding, and re-processing delays.

On page 26, please replace the paragraph starting on line 16, with the following paragraph:

Searcher element 712 can be designed to include a PN despreader, a PN generator, and a signal quality measurement element. The PN generator generates the complex PN sequence at various time offsets, possibly as directed by controller 370, which are used in the search for the strongest multipaths. For each time offset to be ~~search~~ searched, the PN despreader receives and despreads the $I_{IN}$ and $Q_{IN}$ samples with the complex PN sequence at the particular time offset to provide despread samples. The signal quality of the despread samples is then estimated. This can be achieved by computing the energy of each despread sample (i.e., $I_{DES}^2 + Q_{DES}^2$) and accumulating the energy over a particular time period (e.g., the pilot reference period). Searcher element performs the search at numerous time offsets, and the multipaths having the highest signal quality measurements are selected. The available finger processors 710 are then assigned to process these multipaths.

On page 26, please replace the paragraph starting on line 29, with the following paragraph:

The design and operation of a rake receiver for [[an]] a CDMA system is described in further detail in U.S. Patent No. 5,764,687, entitled "MOBILE DEMODULATOR ARCHITECTURE FOR A SPREAD SPECTRUM MULTIPLE ACCESS COMMUNICATION SYSTEM," and U.S. Patent No. 5,490,165, entitled "DEMODULATION ELEMENT ASSIGNMENT IN A SYSTEM CAPABLE OF RECEIVING MULTIPLE SIGNALS," both assigned to the assignee of the present invention and incorporated herein by reference.

On page 28, please replace the paragraph starting on line 27, with the following paragraph:

For a conventional rake receiver, the received signal quality can be estimated by computing the signal-to-noise (S/N) ratio. For CDMA systems that transmit TDM pilot reference, the S/N can be computed during the pilot reference period when the received signal is known. A signal quality estimate can be generated for each assigned finger processor. The

estimates for all assigned finger processors can then be weighted and combined to generate an overall S/N, which can be computed as:

$$S/N_{RAKE} = \frac{\left(\sum_{i=1}^{K} \beta_i \cdot \sqrt{Es_i}\right)^2}{\sum_{i=1}^{K} \beta_i^2 \cdot Nt_i} \qquad \text{Eq (20)}$$

where $\beta$ is the weighting factors used by the rake receiver to combine the demodulated symbols from the assigned finger processors to provide the recovered symbols that are improved estimates of the transmitted data, $Es$ is the energy-per-symbol for the desired signal (e.g., the pilot), and $Nt$ is the total noise on the received signal being processed by the finger processor. $Nt$ typically includes thermal noise, interference from other transmitting base stations, interference from other multipaths from the same base station, and other components. The energy-per-symbol can be computed as:

$$Es = \frac{1}{N_{SYM}} \sum_{i=1}^{N_{SYM}} \left(P_I^2(i) + P_Q^2(i)\right) \, , \qquad \text{Eq (21)}$$

where $P_I$ and $P_Q$ are the inphase and quadrature filtered pilot symbols, and $N_{SYM}$ is the number of symbols over which the energy is accumulated to provide the $Es$ value. Referring to FIG. 7, the filtered pilot symbols can be generated by accumulating the despread samples over the length of the channelization code used to cover the pilot reference. The total noise can be estimated as the energy of the variations in the energy of the desired signal, which can be computed as:

$$Nt = \frac{1}{N_{SYM}-1} \left\{ \sum_{i=1}^{N_{SYM}} \left(P_I^2(i) + P_Q^2(i)\right) - \frac{1}{N_{SYM}} \left(\sum_{i=1}^{N_{SYM}} P_I(i)\right)^2 - \frac{1}{N_{SYM}} \left(\sum_{i=1}^{N_{SYM}} P_Q(i)\right)^2 \right\} \, .$$

$$\text{Eq (22)}$$

The measurement of the received signal quality is described in further detail in U.S. Patent No. 5,903,554, entitled "METHOD AND APPARATUS FOR MEASURING LINK QUALITY IN A SPREAD SPRECTRUM SPECTRUM COMMUNICATION SYSTEM," and U.S. Patent No. 5,799,005, entitled "SYSTEM AND METHOD FOR DETERMINING RECEIVED PILOT POWER AND PATH LOSS IN A CDMA COMMUNICATION SYSTEM," both assigned to the assignee of the present invention and incorporated herein by reference.

On page 29, please replace the paragraph starting on line 25, with the following paragraph:

For the signal processing path that includes equalizer 310, the signal quality can be estimated using various criteria, including a mean square ~~average~~ error (MSE). Again, for CDMA systems that transmit TDM pilot reference, the MSE can be estimated during the pilot reference period, and can be computed as:

$$MSE = \frac{1}{N_{SAM}} \sum_{n=1}^{N_{SAM}} |y(n) - \hat{y}(n)|^2 \quad , \qquad\qquad \text{Eq (23)}$$

where $N_{SAM}$ is the number of samples over which the error is accumulated to provide the MSE. Typically, the mean square error is averaged over a number of samples, and over one or more pilot references, to obtain a desired level of confidence in the measurement. The mean square error can then be translated to an equivalent signal-to-noise ratio, which can be expressed as:

$$
\begin{aligned}
S/N_{EQ} \quad &= \frac{1}{MSE} - 1 \qquad\qquad linear \\
&= 10\log\left(\frac{1}{MSE} - 1\right) \quad dB
\end{aligned}
\qquad\qquad \text{Eq (24)}
$$